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The magnetic stored energy in fusion device is an important parameter to design superconducting magnets, electrical power system and structure components. This paper reports an estimation of magnetic stored energy and its reduction in FFHR. This report handles FFHR as an electromagnetic machine.

Fig. 1 shows a coil position of FFHR. In this figure, helical coil position and its coil current are fixed. The total magnetic energy stored in the FFHR is estimated using a coil inductance matrix and coil currents using following equation.

$$U = [I]^t[L][I],$$

where U is stored energy, $[I]$ is coil current vector and $[L]$ is coil inductance matrix.

Fig. 2 shows the estimated stored energy. In the calculation of inductance matrix, the cross section of poloidal coil is fixed to simplify. This figure shows that the energy becomes about 1.2 TG (1,200 GJ) and it changes with vertical field coil position. Fig. 3 shows the change of stored energy by distribution of the magnetic motive force between OV and IV coils when poloidal coil position is 6m from plasma center. This figure point out that the stored energy becomes minimum when OV coil generate all of vertical field and IV coils are removed. The another estimation, that divides OV coils in 4 coils, 15% of stored energy is reduced.

With these estimation, it is cleared that the stored energy becomes 1.2TJ in current design. Also it shows the way for reduction of the stored energy. For example, when we remove IV coils, divide OV coils in 4 parts and set them beside of helical coils, the stored energy will be reduced to 700GJ.

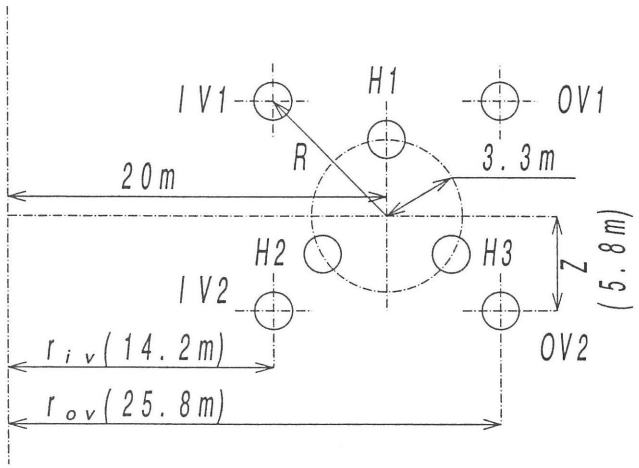

Fig. 1. Coil Position of FFHR

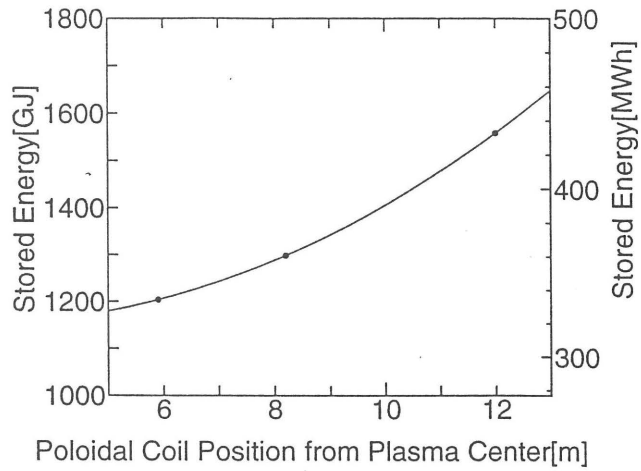

Fig. 2. Change of Magnetic Stored Energy by Poloidal Coil Position

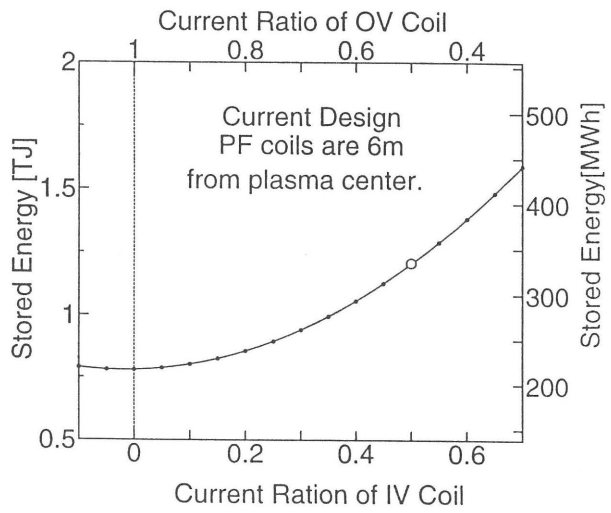

Fig. 3. Change of Magnetic Stored Energy by Current Distribution between OV and IV Coils